

# SEQUENCE LISTING

<110> Demmer, Jeroen  
Shenk, Michael Andrew  
Hall, Claire  
Fish, Steven A

<120> Antifreeze proteins isolated from forage  
grasses and methods for their use.

<130> 11000.1070U

<150> 60/409,557

<151> 2002-09-09

<160> 44

<170> FastSEQ for Windows Version 4.0

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<212> DNA

<213> Festuca arundinacea

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<213> Festuca arundinacea

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<213> Festuca arundinacea

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<213> Festuca arundinacea

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<213> Festuca arundinacea

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<210> 12

<211> 1007

<212> DNA

<213> Festuca arundinacea

<400> 12

ggagtcactt	gcattgcatt	gcaggaaagg	tttcttattg	aatccatcta	tagcatagca	60
ctgctgaatc	catggcgaaa	tgcttgatgc	tgcttctctc	cttcgcgttc	ctcttgtcgg	120
cggccggcac	ggcgacggcg	acggcgacgc	catgccaccg	cgatgacctt	cgcgcgctgc	180
ggggcttcgc	tgagaacctg	ggcggcggcg	gcgcactcag	cctccgcgcc	gcgtggtcag	240
gcgcctcatg	ctgcgattgg	gaaggcggtg	gctgcgacgg	tgccagcggc	cgtgtcacgg	300
ctttgtggct	ccccaggagc	ggcctcacgg	ggccaatccc	gtcatggatt	tttcagcttc	360
accacctacg	ctacttggat	ctttcaggta	atgcattggg	tggcgaggta	cccaagaatc	420
tgcaggtaca	gctcaaaggc	atcaccaaca	tgccattgca	tgtgatgcgt	aacagaagat	480
cactcgacga	gcagcccaat	acaatttctg	ggagcaacaa	tactgtcaga	tccgggagca	540
aaaatgttct	tgctgggaat	gacaacaccg	tcatatctgg	ggacaacaat	agtgtgtctg	600
ggagcaacaa	cactgtcgtg	agtgggaatg	acaataccgt	aaccggcagc	aaccatgtcg	660
tatcagggac	aaaccatatc	gttacagaca	acaacaataa	cgtatccggg	aacgataata	720
atgtatccgg	gagctttcat	accgtatccg	gggggcacaa	tactgtctcc	gggagcaaca	780
ataccgtatc	tgggagcaac	cacgttgtat	ctggaagcaa	caaagtcgtg	acagacgctt	840
aatgatctgt	cagcgcgatga	ttgtttccac	cttaactgag	ctcacgttct	tgtccaagtt	900
cactgtacct	cacagtcagt	tgggtgcgttc	aatcgcgtta	tgttaacttca	tggatatacc	960
atacttttcc	tactatatat	aaaatttccc	tttacataaa	aaaaaaa		1007

<210> 13

<211> 1083

<212> DNA

<213> Lolium perenne

<400> 13

acttgcattc	caaaaagggt	tcttgcatac	acgtatttag	aacaccagaa	cttaatccat	60
ggcgaaatgt	tggtctgtgc	tgctcttctt	ggtgttcttc	ttgctggcca	tgagcgcgac	120
gtcgtgccac	ctggatgacc	tccgcgcgct	gcggggcttt	gtcgggaacc	tcaatggcgg	180
gggtgccctt	ctccgtggaa	catggtctgg	ctcctcatgc	tgcgattggg	aaggtgtggg	240
ctgcgatggg	acaagcggcc	gcgtcacggc	ggtgcggctt	ccgattagcc	tgcaggactg	300
cggtaagctc	aagtcgctca	accttgccaa	cgaaagattg	ggtggcacca	tcccgctcgtg	360
gattgggtgag	cttgaccacc	attgctactt	ggttctctcg	gataattcat	tggttggtaa	420
ggcacccaat	agtttgacac	atagtttgca	gataagactc	aagggcctcg	ccaccgctgg	480
tcgttcaacta	ggtatggctt	tcgctaacat	gccattgcat	gtgaagggga	accgaagaac	540
cctcgacgaa	caaacaata	caatacatgg	gaccaacaac	actgttagat	ctgggaacga	600
caatgctggt	tctgggaacg	acaacactgt	catatgtggg	aacaacaaca	ctgtgtctgg	660
gagcaacaac	accattgcat	ctggcagtg	caatatcgta	actggcagca	accatattgt	720
atgtggggacc	aaacatatca	taactgataa	caacaatgac	gtatccggca	atgataataa	780

tgtatctggg	agcttccata	ctgtatccgg	gagccacaat	actgtatctg	gaagtaacaa	840
cactgtatct	ggaagcaacc	atgtcgtatc	tggaagcaac	aaagtcgtga	caggagatga	900
atgatttgtc	aggggattgc	ttccatcttt	cctaaaggag	ctctcaccct	agtccaagtt	960
cggatgcagct	cacaatcact	tggtagggac	aatcgagtta	tgtaacttca	tgatatatgc	1020
atcattctcc	ctgtttaaat	atactttcct	gaaaatatct	tacataaatg	ctgaaaaaaa	1080
aaa						1083

<210> 14

<211> 243

<212> PRT

<213> Festuca arundinacea

<400> 14

Met	Ala	Lys	Cys	Trp	Gln	Leu	Leu	Leu	Phe	Leu	Ala	Leu	Leu	Leu	Pro
1			5						10					15	
Ala	Ala	Ser	Ala	Ala	Ser	Cys	His	Pro	Asp	Asp	Leu	Tyr	Ala	Leu	Arg
			20					25					30		
Asp	Phe	Ala	Gly	Asn	Leu	Arg	Gly	Gly	Gly	Val	Leu	Leu	Arg	Ala	Ala
			35				40						45		
Leu	Pro	Gly	Ala	Ser	Cys	Cys	Gly	Trp	Glu	Gly	Val	Gly	Cys	Asp	Gly
	50					55					60				
Ala	Ser	Gly	Cys	Val	Lys	Ser	Phe	Gln	Ile	Leu	Leu	Lys	Gly	Leu	Thr
65					70					75					80
Ala	Ala	Gly	Arg	Ser	Leu	Gly	Lys	Ala	Phe	Thr	His	Met	Pro	Leu	His
				85					90					95	
Val	Lys	Pro	Ser	Gln	Gly	Thr	Leu	Asp	Glu	Asp	His	Asn	Thr	Ile	Thr
			100					105					110		
Gly	Ile	Asn	Asn	Thr	Val	Arg	Ser	Gly	Ser	Asn	Asn	Val	Val	Ser	Gly
		115				120						125			
Asn	Asp	Asn	Thr	Val	Ile	Ser	Gly	Asn	Asn	Asn	Val	Val	Ser	Gly	Ser
	130					135					140				
His	Asn	Thr	Val	Val	Phe	Gly	Gly	Asp	Asn	Phe	Ile	Ser	Gly	Ser	Tyr
145					150					155					160
His	Val	Val	Ser	Gly	Asn	His	His	Val	Val	Thr	Asp	Asn	Lys	Asn	Ala
				165					170					175	
Val	Ser	Gly	Asp	His	Asn	Thr	Val	Ser	Gly	Ser	Gln	Asn	Thr	Val	Ser
			180					185					190		
Gly	Asn	His	Gln	Ile	Val	Ser	Gly	Ser	His	Ser	Thr	Val	Ser	Gly	Asn
	195					200						205			
His	Asn	Thr	Val	Ser	Gly	Arg	Asn	Asn	Ser	Val	Tyr	Gly	Asn	Asn	Asn
	210					215					220				
Ile	Val	Ser	Gly	Ser	Asn	His	Val	Val	Tyr	Gly	Asn	Asn	Lys	Val	Val
225					230					235					240
Thr	Gly	Gly													

<210> 15

<211> 243

<212> PRT

<213> Festuca arundinacea

<400> 15

Met	Ala	Lys	Cys	Trp	Gln	Leu	Leu	Leu	Phe	Leu	Ala	Phe	Leu	Leu	Pro
1			5						10					15	
Ala	Ala	Ser	Ala	Ala	Ser	Arg	His	Pro	Asp	Asp	Leu	Arg	Ala	Leu	Gln
			20					25				30			
Asp	Phe	Ala	Gly	Asn	Leu	Arg	Gly	Gly	Gly	Val	Val	Leu	Arg	Ala	Ala





			180					185				190							
Val	Val	Thr	Gly	Ser	Asp	Asn	Thr	Val	Val	Gly	Ser	Asn	His	Val	Val				
		195						200				205							
Ser	Gly	Thr	Lys	His	Ile	Val	Thr	Asp	Asn	Asn	Asn	Val	Val	Ser	Gly				
	210					215					220								
Asn	Asp	Asn	Asn	Val	Ser	Gly	Ser	Phe	His	Thr	Val	Ser	Gly	Glu	His				
225					230					235					240				
Asn	Thr	Val	Ser	Gly	Ser	Asn	Asn	Thr	Val	Ser	Gly	Ser	Asn	His	Ile				
			245						250					255					
Val	Ser	Gly	Ser	Asn	Lys	Val	Val	Thr	Asp	Gly									
			260					265											

<210> 17  
 <211> 269  
 <212> PRT  
 <213> Festuca arundinacea

<220>  
 <221> VARIANT  
 <222> (1)...(269)  
 <223> Xaa = Any Amino Acid

<400> 17																			
Met	Pro	Glu	Tyr	Met	Ala	Lys	Cys	Cys	Met	Leu	Leu	Leu	Leu	Leu	Ala				
1				5					10					15					
Phe	Ile	Leu	Leu	Gln	Val	Ala	Gly	Ala	Thr	Ser	Trp	Ser	Cys	His	His				
		20						25					30						
Asp	Asp	Leu	Arg	Ala	Leu	Arg	Gly	Phe	Ala	Glu	Asn	Leu	Ser	Gly	Lys				
		35					40					45							
Gly	Ala	Val	Arg	Leu	Arg	Ala	Ala	Trp	Ser	Gly	Ala	Ser	Cys	Cys	Ser				
	50					55					60								
Trp	Glu	Gly	Val	Gly	Cys	Glu	Thr	Ala	Ser	Gly	Arg	Val	Ala	Ala	Leu				
65				70						75					80				
Arg	Leu	Pro	Lys	Arg	Gly	Leu	Gly	Gly	Thr	Ile	Pro	Ser	Ser	Ile	Gly				
			85						90					95					
Glu	Leu	Asp	His	Leu	Arg	Cys	Leu	Asp	Leu	Ser	Gly	Asn	Ser	Leu	Val				
		100						105					110						
Gly	Lys	Val	Pro	Lys	Ser	Leu	Gln	Ile	Arg	Leu	Xaa	Ser	Leu	Ser	Thr				
		115					120					125							
Asp	Gly	Gln	Ser	Leu	Gly	Met	Gly	Ser	Ile	Asn	Thr	Leu	Leu	His	Val				
	130					135					140								
Ser	Ser	Asn	Arg	Arg	Thr	Leu	Asp	Glu	Glu	Pro	Asn	Thr	Ile	Ser	Gly				
145					150					155					160				
Thr	Asn	Asn	Ser	Val	Gly	Ser	Gly	Ser	Asn	Asn	Val	Val	Ser	Gly	Asn				
			165						170					175					
Asp	Asn	Thr	Val	Ile	Ser	Gly	Asn	Asn	His	Val	Ser	Gly	Ser	Asn					
		180						185					190						
Asn	Thr	Val	Val	Thr	Gly	Ser	Asp	Asn	Thr	Leu	Val	Gly	Ser	Asn	His				
		195					200					205							
Val	Val	Ser	Gly	Thr	Lys	His	Ile	Val	Thr	Asp	Asn	Asn	Asn	Val	Val				
	210					215					220								
Ser	Gly	Asn	Asp	Asn	Asn	Val	Ser	Gly	Ser	Phe	His	Thr	Val	Ser	Gly				
225					230					235					240				
Glu	His	Asn	Thr	Val	Ser	Gly	Ser	Asn	Asn	Thr	Val	Ser	Gly	Ser	Asn				
			245						250					255					
His	Val	Val	Ser	Gly	Ser	Asn	Lys	Val	Val	Thr	Asp	Gly							

260

265

<210> 18  
 <211> 281  
 <212> PRT  
 <213> Festuca arundinacea

<400> 18  
 Met Ala Lys Cys Trp Leu Leu Leu Leu Phe Leu Val Phe Leu Leu Leu  
 1 5 10 15  
 Ala Met Ser Ala Thr Ser Cys His Leu Asp Asp Leu Arg Ala Leu Arg  
 20 25 30  
 Gly Phe Val Gly Asn Leu Asn Gly Gly Gly Ala Leu Leu Arg Gly Thr  
 35 40 45  
 Trp Ser Gly Ser Ser Cys Cys Asp Trp Glu Gly Val Gly Cys Asp Gly  
 50 55 60  
 Thr Ser Gly Arg Val Thr Ala Leu Arg Leu Pro Ile Ser Leu Glu Asp  
 65 70 75 80  
 Cys Gly Lys Leu Lys Ser Leu Asn Leu Ala Asn Glu Arg Leu Val Gly  
 85 90 95  
 Thr Ile Pro Ser Trp Ile Gly Glu Leu Asp His His Cys Tyr Leu Val  
 100 105 110  
 Leu Ser Asp Asn Ser Leu Val Gly Lys Ala Pro Asn Ser Leu His Asn  
 115 120 125  
 Ser Leu Gln Ile Arg Leu Lys Gly Leu Ala Thr Ala Gly Arg Ser Leu  
 130 135 140  
 Gly Met Ala Phe Ala Asn Met Pro Leu His Val Lys Gly Asn Arg Arg  
 145 150 155 160  
 Thr Leu Asp Glu Gln Thr Asn Thr Ile His Gly Thr Asn Asn Thr Val  
 165 170 175  
 Arg Ser Gly Asn Asp Asn Ala Val Ser Gly Asn Asp Asn Thr Val Ile  
 180 185 190  
 Cys Gly Asn Asn Asn Thr Val Ser Gly Ser Asn Asn Thr Ile Ala Ser  
 195 200 205  
 Gly Ser Asp Asn Ile Val Thr Gly Ser Asn His Ile Val Cys Gly Thr  
 210 215 220  
 Lys His Ile Ile Thr Asp Asn Asn Asn Asp Val Ser Gly Asn Asp Asn  
 225 230 235 240  
 Asn Val Ser Gly Ser Phe His Thr Val Ser Gly Ser His Asn Thr Val  
 245 250 255  
 Ser Gly Ser Asn Thr Val Ser Gly Ser Asn His Val Val Ser Gly  
 260 265 270  
 Ser Asn Lys Leu Val Thr Gly Asp Glu  
 275 280

<210> 19  
 <211> 277  
 <212> PRT  
 <213> Festuca arundinacea

<400> 19  
 Met Ala Lys Cys Trp Leu Leu Leu Leu Phe Leu Val Val Leu Leu Pro  
 1 5 10 15  
 Ala Ala Ser Ala Thr Ser Cys His Pro Asp Asp Leu Arg Ala Leu Arg  
 20 25 30  
 Gly Phe Val Gly Asn Leu Asn Gly Gly Gly Val Leu Leu His Gly Ala  
 35 40 45

Trp Ser Gly Ser Leu Cys Cys Ala Trp Glu Gly Val Gly Cys Asp Gly  
 50 55 60  
 Thr Ser Gly Arg Val Thr Ala Leu Arg Leu Pro Ile Ser Leu Lys Asp  
 65 70 75 80  
 Cys Gly Lys Leu Lys Ser Leu Asn Leu Ala Asn Asp Arg Leu Val Gly  
 85 90 95  
 Thr Ile Pro Ser Trp Ile Gly Glu Leu Asp His Leu Cys Tyr Leu Val  
 100 105 110  
 Leu Ser Asp Asn Ser Leu Val Gly Lys Val Pro Asn Ser Leu Gln Ile  
 115 120 125  
 Arg Leu Lys Gly Leu Ala Thr Ala Gly Arg Ser Leu Gly Met Ala Phe  
 130 135 140  
 Ala Asn Met Pro Leu His Val Lys Gly Asn Arg Arg Thr Leu Asp Glu  
 145 150 155 160  
 Gln Thr Asn Thr Ile Gln Gly Thr Asn Asn Thr Val Arg Ser Gly Asn  
 165 170 175  
 Asp Asn Ala Val Ser Gly Asn Asp Asn Thr Val Ile Cys Gly Asn Asn  
 180 185 190  
 Asn Thr Val Ser Gly Ser Asn Asn Thr Ile Val Ser Gly Ser Asp Asn  
 195 200 205  
 Ile Val Thr Gly Ser Asn Gln Val Val Cys Gly Thr Lys His Ile Ile  
 210 215 220  
 Thr Asp Asn Asn Asn Asp Val Ser Gly Asn Asp Asn Asn Val Ser Gly  
 225 230 235 240  
 Ser Ser His Thr Val Ser Gly Ser His Asn Thr Val Ser Gly Ser Asn  
 245 250 255  
 Asn Thr Val Ser Gly Ser Asn His Val Val Ser Gly Ser Asn Lys Val  
 260 265 270  
 Val Thr Gly Asp Glu  
 275

<210> 20

<211> 277

<212> PRT

<213> Festuca arundinacea

<400> 20

Met Ala Lys Cys Trp Leu Leu Leu Leu Phe Leu Val Phe Leu Leu Leu  
 1 5 10 15  
 Ala Val Cys Ala Thr Ser Cys His Pro Asp Asp Leu Arg Ala Leu Arg  
 20 25 30  
 Gly Phe Val Gly Asn Leu Asn Gly Gly Gly Val Leu Leu Arg Glu Thr  
 35 40 45  
 Trp Ser Gly Ser Ser Cys Cys Ala Trp Glu Gly Val Gly Cys Asp Gly  
 50 55 60  
 Thr Ser Gly Arg Val Thr Ala Leu Arg Leu Pro Ile Ser Leu Glu Asp  
 65 70 75 80  
 Cys Gly Lys Leu Lys Ser Leu Asn Leu Ala Asn Glu Arg Leu Val Gly  
 85 90 95  
 Thr Ile Pro Ser Trp Ile Gly Glu Leu Asp His His Cys Tyr Phe Val  
 100 105 110  
 Leu Ser Asp Asn Ser Leu Val Gly Lys Val Pro Asn Ser Leu Gln Ile  
 115 120 125  
 Arg Leu Lys Gly Leu Ala Thr Ala Gly Arg Ser Leu Gly Met Ala Phe  
 130 135 140  
 Ala Asn Met Pro Leu His Val Lys Gly Asn Arg Arg Thr Leu Asp Glu  
 145 150 155 160

Gln	Thr	Asn	Thr	Ile	His	Gly	Thr	Asn	Asn	Thr	Val	Arg	Ser	Gly	Asn	
				165					170					175		
Asp	Asn	Ala	Val	Ser	Gly	Asn	Asp	Asn	Thr	Val	Met	Cys	Gly	Asn	Asn	
			180					185					190			
Asn	Thr	Val	Ser	Gly	Ser	Asn	Asn	Thr	Ile	Ser	Ser	Gly	Ser	Asp	Asn	
		195					200					205				
Ile	Val	Thr	Gly	Ser	Asn	His	Ile	Val	Cys	Gly	Thr	Lys	His	Ile	Ile	
	210					215					220					
Thr	Asp	Asn	Asn	Asn	Asp	Val	Ser	Gly	Asn	Asp	Asn	Asn	Val	Ser	Gly	
225					230					235					240	
Ser	Phe	His	Thr	Val	Ser	Gly	Ser	His	Asn	Thr	Val	Ser	Gly	Ser	Asn	
				245					250					255		
Asn	Thr	Val	Ser	Gly	Ser	Asn	His	Val	Val	Ser	Gly	Ser	Asn	Lys	Val	
			260					265					270			
Val	Thr	Gly	Asp	Glu												
		275														

<210> 21

<211> 280

<212> PRT

<213> Festuca arundinacea

<400> 21

Met	Gly	Leu	Leu	Leu	Leu	Phe	Leu	Ala	Phe	Leu	Leu	Pro	Val	Ala	Cys	
1				5					10					15		
Ala	Ala	Thr	Ser	Ser	Cys	His	Pro	Asp	Asp	Leu	Arg	Ala	Leu	Arg	Gly	
			20					25					30			
Phe	Ala	Lys	Asn	Leu	Gly	Gly	Gly	Gly	Val	Leu	Leu	Arg	Thr	Ala	Trp	
		35				40						45				
Ser	Gly	Thr	Ser	Cys	Cys	Val	Trp	Glu	Gly	Val	Gly	Cys	Asn	Gly	Ala	
	50				55					60						
Ser	Gly	Arg	Val	Thr	Thr	Leu	Trp	Leu	Pro	Arg	Arg	Gly	Leu	Ala	Gly	
65				70					75					80		
Thr	Ile	Thr	Gly	Ala	Ser	Leu	Ala	Gly	Leu	Ala	Arg	Leu	Glu	Ser	Leu	
			85					90					95			
Asn	Leu	Ala	Asn	Asn	Arg	Leu	Val	Gly	Thr	Ile	Pro	Ser	Trp	Ile	Gly	
		100						105					110			
Glu	Leu	Asp	His	Leu	Leu	Tyr	Leu	Asp	Leu	Ser	His	Asn	Ser	Leu	Val	
		115				120					125					
Gly	Glu	Leu	Pro	Asn	Leu	Lys	Gly	Leu	Thr	Thr	Thr	Gly	His	Leu	Leu	
	130					135					140					
Gly	Met	Ala	Phe	Thr	Ser	Met	Pro	Leu	Asp	Val	Lys	Pro	Asn	Arg	Arg	
145				150					155					160		
Thr	Leu	Ala	Val	Gln	Pro	Asn	Thr	Ile	Ser	Gly	Thr	Asn	Asn	Ser	Val	
			165					170						175		
Leu	Ser	Gly	Arg	Asn	Asn	Thr	Val	Ser	Gly	Asn	Asp	Asn	Thr	Val	Ile	
		180						185					190			
Ser	Gly	Asn	Asn	Asn	Thr	Val	Ser	Gly	Ser	Phe	Asn	Thr	Val	Val	Thr	
	195					200						205				
Gly	Ser	Asp	Asn	Val	Leu	Thr	Gly	Ser	Asn	His	Val	Val	Ser	Gly	Arg	
	210					215					220					
Asn	His	Ile	Val	Thr	Asp	Asn	Asn	Asn	Ala	Val	Ser	Gly	Asp	Asp	Asn	
225				230					235					240		
Asn	Val	Ser	Gly	Ser	Phe	His	Lys	Val	Ser	Gly	Ser	His	Asn	Thr	Val	
			245					250					255			
Ser	Gly	Ser	Asn	Asn	Thr	Val	Ser	Gly	Arg	Asn	His	Val	Val	Ser	Gly	
		260						265					270			

Ser Asn Lys Val Val Thr Gly Gly  
 275 280

<210> 22

<211> 285

<212> PRT

<213> Festuca arundinacea

<400> 22

Met Gly Leu Leu Leu Leu Phe Leu Gly Phe Leu Leu Pro Ala Ala Cys  
 1 5 10 15  
 Ala Ala Thr Ser Ser Cys His Pro Asp Asp Leu Arg Ala Leu Arg Gly  
 20 25 30  
 Phe Ala Lys Asn Val Gly Gly Gly Gly Val Leu Leu Arg Thr Ala Trp  
 35 40 45  
 Ser Gly Thr Ser Cys Cys Val Trp Glu Gly Val Gly Cys Asn Gly Ala  
 50 55 60  
 Ser Gly Arg Ile Thr Thr Leu Trp Leu Pro Arg Arg Gly Leu Ala Gly  
 65 70 75 80  
 Thr Ile Thr Gly Ala Ser Leu Ala Gly Leu Ala Arg Leu Glu Ser Leu  
 85 90 95  
 Asn Leu Ala Asn Asn Arg Leu Val Gly Thr Ile Pro Ser Trp Ile Gly  
 100 105 110  
 Glu Leu Asp His Leu Leu Tyr Leu Asp Leu Ser His Asn Ser Leu Val  
 115 120 125  
 Gly Glu Leu Pro Asn Arg Leu Gln Ile Arg Leu Lys Gly Leu Thr Thr  
 130 135 140  
 Thr Gly His Leu Leu Gly Met Ala Phe Thr Asn Met Pro Leu Asp Val  
 145 150 155 160  
 Lys Arg Asn Arg Arg Thr Leu Ala Ile Gln Pro Asn Thr Ile Ser Gly  
 165 170 175  
 Thr Asn Asn Leu Val Leu Ser Gly Arg Asn Asn Val Val Ser Gly Asn  
 180 185 190  
 Asp Asn Thr Val Ile Ser Glu Asn Asn Asn Thr Val Ser Gly Ser Phe  
 195 200 205  
 Asn Thr Val Ile Thr Gly Ser Asp Asn Val Leu Thr Gly Ser Asn His  
 210 215 220  
 Val Val Ser Gly Arg Ser His Ile Val Thr Asp Asn Asn Asn Ser Val  
 225 230 235 240  
 Ser Gly Asp Asp Asn Asn Val Ser Gly Ser Phe His Lys Val Ser Gly  
 245 250 255  
 Ser His Asn Thr Val Ser Gly Ser Asn Asn Thr Val Ser Gly Arg Asn  
 260 265 270  
 His Val Val Ser Gly Ser Asn Lys Ile Val Thr Gly Gly  
 275 280 285

<210> 23

<211> 254

<212> PRT

<213> Festuca arundinacea

<400> 23

Met Ala Lys Cys Leu Met Leu Leu Leu Ser Phe Ala Phe Leu Leu Ser  
 1 5 10 15  
 Val Ala Gly Thr Ala Thr Ala Thr Pro Cys His Arg Asp Asp Leu Arg  
 20 25 30  
 Ala Leu Arg Gly Phe Ala Glu Asn Leu Gly Gly Gly Gly Ala Ile Ser

	35					40				45					
Leu	Arg	Ala	Ala	Trp	Ser	Gly	Ala	Ser	Cys	Cys	Asp	Trp	Glu	Gly	Val
50						55					60				
Gly	Cys	Asp	Gly	Ala	Ser	Gly	Arg	Val	Thr	Ala	Leu	Trp	Leu	Pro	Arg
65					70					75					80
Ser	Gly	Leu	Thr	Gly	Pro	Ile	Pro	Ser	Trp	Ile	Cys	Gln	Leu	His	His
				85					90					95	
Leu	Arg	Tyr	Leu	Asp	Leu	Ser	Gly	Asn	Ala	Leu	Val	Gly	Glu	Val	Pro
			100					105					110		
Lys	Asn	Leu	Gln	Val	Gln	Leu	Lys	Gly	Ile	Thr	Asn	Met	Pro	Leu	His
		115					120					125			
Val	Met	Arg	Asn	Arg	Arg	Ser	Leu	Asp	Glu	Gln	Pro	Asn	Thr	Ile	Ser

	130					135				140					
Gly	Ser	Asn	Asn	Thr	Val	Arg	Ser	Gly	Ser	Lys	Asn	Val	Leu	Ala	Gly
145					150					155					160
Asn	Asp	Asn	Thr	Val	Ile	Ser	Gly	Asp	Asn	Asn	Ser	Val	Ser	Gly	Ser
				165					170					175	
Asn	Asn	Thr	Val	Val	Ser	Gly	Asn	Asp	Asn	Thr	Val	Thr	Gly	Ser	Asn
			180					185					190		
His	Val	Val	Ser	Gly	Thr	Asn	His	Ile	Val	Thr	Asp	Asn	Asn	Asn	Asn
		195				200					205				
Val	Ser	Gly	Asn	Asp	Asn	Asn	Val	Ser	Gly	Ser	Phe	His	Thr	Val	Ser
	210					215					220				
Gly	Gly	His	Asn	Thr	Val	Ser	Gly	Ser	Asn	Asn	Thr	Val	Ser	Gly	Ser
225					230					235					240
Asn	His	Val	Val	Ser	Gly	Ser	Asn	Lys	Val	Val	Thr	Asp	Ala		
				245					250						

<210> 24

<211> 262

<212> PRT

<213> Festuca arundinacea

<400> 24

Met	Ala	Lys	Cys	Leu	Met	Leu	Leu	Leu	Ser	Phe	Ala	Phe	Leu	Leu	Ser
1				5					10					15	
Ala	Ala	Gly	Thr	Ala	Thr	Ala	Thr	Pro	Cys	His	Arg	Asp	Asp	Leu	Arg
			20					25				30			
Ala	Leu	Arg	Gly	Phe	Ala	Glu	Asn	Leu	Gly	Gly	Gly	Gly	Ala	Leu	Ser
	35						40				45				
Leu	Arg	Ala	Ala	Trp	Ser	Gly	Ala	Ser	Cys	Cys	Asp	Trp	Glu	Gly	Val
50					55						60				
Gly	Cys	Asp	Gly	Ala	Ser	Gly	Arg	Val	Thr	Ala	Leu	Trp	Leu	Pro	Arg
65					70					75					80
Ser	Gly	Leu	Thr	Gly	Pro	Ile	Pro	Ser	Trp	Ile	Cys	Gln	Leu	His	His
				85					90					95	
Leu	Arg	Tyr	Leu	Asp	Leu	Ser	Gly	Asn	Ala	Leu	Val	Gly	Glu	Val	Pro
			100					105					110		
Lys	Asn	Leu	Gln	Val	Gln	Leu	Lys	Gly	Leu	Thr	Ala	Ala	Gly	Arg	Ser
	115						120					125			
Gly	Phe	Thr	Asn	Met	Pro	Leu	His	Val	Met	Arg	Asn	Arg	Arg	Ser	Leu
	130					135					140				
Asp	Glu	Gln	Pro	Asn	Thr	Ile	Ser	Gly	Ser	Asn	Asn	Thr	Val	Arg	Ser
145					150					155					160
Gly	Ser	Lys	Asn	Val	Val	Ala	Gly	Asn	Asp	Asn	Thr	Val	Ile	Ser	Gly
				165					170					175	

Asp	Asn	Asn	Ser	Val	Ser	Gly	Ser	Asn	Asn	Thr	Val	Val	Ser	Gly	Ser
			180					185					190		
Asp	Asn	Thr	Val	Thr	Gly	Ser	Asn	His	Val	Val	Ser	Gly	Thr	Asn	His
		195					200					205			
Ile	Val	Thr	Asp	Asn	Asn	Asn	Asn	Val	Ser	Gly	Asn	Asp	Asn	Asn	Val
	210					215					220				
Ser	Gly	Ser	Phe	His	Thr	Val	Ser	Gly	Gly	His	Asn	Thr	Val	Ser	Gly
225					230					235					240
Ser	Asn	Asn	Thr	Val	Ser	Gly	Ser	Asn	His	Val	Val	Ser	Gly	Ser	Asn
			245					250						255	
Lys	Val	Val	Thr	Asp	Ala										
			260												

<210> 25

<211> 256

<212> PRT

<213> Festuca arundinacea

<400> 25

Met	Ala	Lys	Cys	Leu	Met	Leu	Leu	Leu	Ser	Phe	Ala	Phe	Leu	Leu	Ser
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Ala	Ala	Gly	Thr	Ala	Thr	Ala	Thr	Ala	Thr	Pro	Cys	His	Arg	Asp	Asp
			20					25					30		
Leu	Arg	Ala	Leu	Arg	Gly	Phe	Ala	Glu	Asn	Leu	Gly	Gly	Gly	Gly	Ala
		35				40						45			
Leu	Ser	Leu	Arg	Ala	Ala	Trp	Ser	Gly	Ala	Ser	Cys	Cys	Asp	Trp	Glu
	50					55					60				
Gly	Val	Gly	Cys	Asp	Gly	Ala	Ser	Gly	Arg	Val	Thr	Ala	Leu	Trp	Leu
65					70				75						80
Pro	Arg	Ser	Gly	Leu	Thr	Gly	Pro	Ile	Pro	Ser	Trp	Ile	Phe	Gln	Leu
				85				90						95	
His	His	Leu	Arg	Tyr	Leu	Asp	Leu	Ser	Gly	Asn	Ala	Leu	Val	Gly	Glu
			100				105						110		
Val	Pro	Lys	Asn	Leu	Gln	Val	Gln	Leu	Lys	Gly	Ile	Thr	Asn	Met	Pro
		115				120						125			
Leu	His	Val	Met	Arg	Asn	Arg	Ser	Leu	Asp	Glu	Gln	Pro	Asn	Thr	
	130					135				140					
Ile	Ser	Gly	Ser	Asn	Asn	Thr	Val	Arg	Ser	Gly	Ser	Lys	Asn	Val	Leu
145					150					155					160
Ala	Gly	Asn	Asp	Asn	Thr	Val	Ile	Ser	Gly	Asp	Asn	Asn	Ser	Val	Ser
				165					170					175	
Gly	Ser	Asn	Asn	Thr	Val	Val	Ser	Gly	Asn	Asp	Asn	Thr	Val	Thr	Gly
			180					185					190		
Ser	Asn	His	Val	Val	Ser	Gly	Thr	Asn	His	Ile	Val	Thr	Asp	Asn	Asn
		195				200						205			
Asn	Asn	Val	Ser	Gly	Asn	Asp	Asn	Asn	Val	Ser	Gly	Ser	Phe	His	Thr
	210					215					220				
Val	Ser	Gly	Gly	His	Asn	Thr	Val	Ser	Gly	Ser	Asn	Asn	Thr	Val	Ser
225					230					235					240
Gly	Ser	Asn	His	Val	Val	Ser	Gly	Ser	Asn	Lys	Val	Val	Thr	Asp	Ala
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<210> 26

<211> 281

<212> PRT

<213> Lolium perenne

<400> 26

Met Ala Lys Cys Trp Leu Leu Leu Leu Phe Leu Val Phe Leu Leu Leu  
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Ala Met Ser Ala Thr Ser Cys His Leu Asp Asp Leu Arg Ala Leu Arg  
20 25 30  
Gly Phe Val Gly Asn Leu Asn Gly Gly Gly Ala Leu Leu Arg Gly Thr  
35 40 45  
Trp Ser Gly Ser Ser Cys Cys Asp Trp Glu Gly Val Gly Cys Asp Gly  
50 55 60  
Thr Ser Gly Arg Val Thr Ala Leu Arg Leu Pro Ile Ser Leu Glu Asp  
65 70 75 80  
Cys Gly Lys Leu Lys Ser Leu Asn Leu Ala Asn Glu Arg Leu Val Gly  
85 90 95  
Thr Ile Pro Ser Trp Ile Gly Glu Leu Asp His His Cys Tyr Leu Val  
100 105 110  
Leu Ser Asp Asn Ser Leu Val Gly Lys Ala Pro Asn Ser Leu His Asn  
115 120 125  
Ser Leu Gln Ile Arg Leu Lys Gly Leu Ala Thr Ala Gly Arg Ser Leu  
130 135 140  
Gly Met Ala Phe Ala Asn Met Pro Leu His Val Lys Gly Asn Arg Arg  
145 150 155 160  
Thr Leu Asp Glu Gln Thr Asn Thr Ile His Gly Thr Asn Asn Thr Val  
165 170 175  
Arg Ser Gly Asn Asp Asn Ala Val Ser Gly Asn Asp Asn Thr Val Ile  
180 185 190  
Cys Gly Asn Asn Asn Thr Val Ser Gly Ser Asn Asn Thr Ile Ala Ser  
195 200 205  
Gly Ser Asp Asn Ile Val Thr Gly Ser Asn His Ile Val Cys Gly Thr  
210 215 220  
Lys His Ile Ile Thr Asp Asn Asn Asn Asp Val Ser Gly Asn Asp Asn  
225 230 235 240  
Asn Val Ser Gly Ser Phe His Thr Val Ser Gly Ser His Asn Thr Val  
245 250 255  
Ser Gly Ser Asn Asn Thr Val Ser Gly Ser Asn His Val Val Ser Gly  
260 265 270  
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<213> Artificial Sequence

<220>

<223> Made in the lab

<400> 27

gaattcggta ccccatcaac

20

<210> 28

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<212> DNA

<213> Artificial Sequence

<220>

<223> Made in the lab



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33